MPEG Test System

MTS4000 Datasheet

The MTS4000 MPEG Test System provides comprehensive MPEG transport streams analysis and interoperability testing. Its deep analysis of the transport streams, PES, and elementary streams helps track down sources of picture anomalies and identify transport streams with syntax errors. Its ability to capture events for deep analysis is also critical to identifying the root cause of problems. The optional Quality of Experience (QoE) analysis tool shortens the time to find the root cause of problems by identifying impairments and artifacts that can be traced directly to network issues.

Key features

- Industry's fastest analysis engine enables reduced time to insight, rapid development, evaluation, deployment, and diagnostics of next-generation DTV and IPTV systems and services
- A wide range of DTV standards are supported, including MPEG, DVB, ATSC, ISDB, and ISDB-TB (Brazil); specific SI for terrestrial, cable, and satellite, plus regional variations of these standards are also supported
- Range of interfaces and analysis capabilities provide the necessary connectivity to diagnose problems anywhere in the network environment, whether that be transmission links (RF or IP layer) or content processing (TS layer)
- Connect to both IP version 4 and 6 networks, including those using IGMP and MLD multicast protocols respectively
- Analyze both constant and variable bit rate streams (CBR and VBR) [1]
- Integrated cross-layer fault analysis and logging provides a one-box solution for fault diagnosis, reducing time to insight when troubleshooting
- Playout functionality provides stimulus with parametric capabilities and IP multisession replication to characterize behavior of network or Device Under Test (DUT)
- CaptureVu™ technology captures and analyzes system events in real time and deferred time to debug the intermittent and complex problems that traditional analyzers miss
- Innovative program-centric user interface brings expert power to the novice user
- H.264 buffer analysis, multiplexing, and ES compliance checking provide the most powerful suite of tools for the creation and analysis of transport streams containing H.264 content
- Video and audio quality analysis that helps distinguish between impairments resulting from network distribution versus artifacts resulting from compression

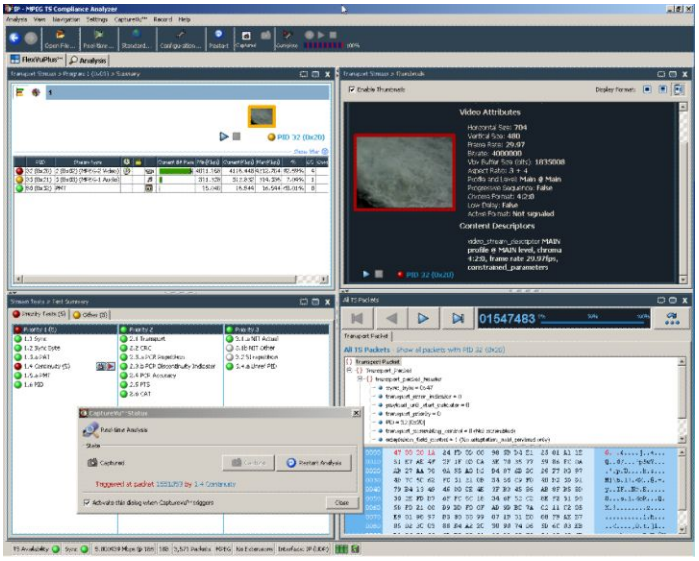
Try before you buy: Demo versions of the TSCA, Multiplexer, and Buffer Analyzer applications are available to download.

Applications

Equipment manufacturers – research & development

- CaptureVu™ technology allows rapid isolation and debugging of equipment and system faults
- High-performance line rate Gigabit Ethernet (GbE) IP connectivity and integrated cross-layer analysis enable diagnosis of complex timing problems in video over IP and IPTV network equipment
- Multiplexer/Remultiplexer allows flexible test stream creation and modification
- Rapid and in-depth analysis of selected elements of transport streams to confirm functionality and compliance to standards
- Set-top box buffer testing and verification
- Elementary stream analysis option for codec design and optimization
- High-accuracy picture quality analysis based upon the Human Vision Model for device design optimization and fault diagnosis

1 Some timing-related measurements are not possible with VBR streams.



MTS4000 CaptureVu™

Equipment manufacturers – manufacturing test

- Tclips Test Streams together with the Multiplexer/Remultiplexer allows custom test stream creation and editing for fast and flexible equipment stress testing
- Stream playout and recording provides a repeatable test source with seamless looping and continuous time-stamping for test and alignment of STBs, IRDs, and modulators
- Multiport ASI and IP interfaces allow multiple devices to be tested simultaneously
- Duplex operation allows end-to-end testing of system network elements

Broadcaster and network operator engineering

- RF and IP connectivity and analysis provide a single-box solution for broadcast system troubleshooting at any point in the network
- Integrated cross-layer fault analysis and logging for network fault diagnosis reduces time to insight when troubleshooting and removes the need for additional IP- or RF-specific diagnostic equipment
- CaptureVu™ technology allows for the isolation of intermittent network problems that other analyzers are not capable of isolating
- Video and audio quality analysis that helps distinguish between impairments resulting from network distribution versus artifacts resulting from compression
- Elementary stream compliance option for evaluating different vendors' compression equipment and diagnosing faults

Summary of MTS4000 tools

- Standard tools
  - Real- and Deferred-time Transport Stream Compliance Analyzer (TSCA) including Carousel Analyzer, GbE (NIC) Interface
  - Player
  - TS Cutter
- Optional tools
  - Video Quality Software, Single Ended; Includes VQS1000 with all options
  - Picture Quality Analysis Software, Single and Double Ended; includes PQASW with IP option
  - Stream Generations including Multiplexer, TS Editor, Make Seamless, Carousel Generator, and Tclips Test Streams
  - Standard ES Analysis including MTS4CC with all options plus MPEG-2 ES Analyzer
  - Enhanced ES Analysis includes MTS4EAV7 (base software or with all options) plus MPEG-2 ES Analyzer
  - PES and T-STD Buffer Analyzer

Summary of available MTS4000 interfaces

- Standard interface
  - Ethernet IP (10/100/1000BASE-T)
- Optional interfaces
  - Multiport ASI interface
  - IPTV Gigabit Ethernet interface (10/100/1000BASE-T, 1000BASE-SX, LX, ZX)
  - 10GBASE-SR dual optical port 10 Gb/s NIC; includes short-reach SFP+ modules (850 nm)
  - DVB-C: QAM B
  - ATSC-T: 8VSB
  - DVB-S/S2 interface supporting QPSK, 8PSK, 16APSK and 32APSK demodulation

Transport Stream Compliance Analyzer (TSCA)

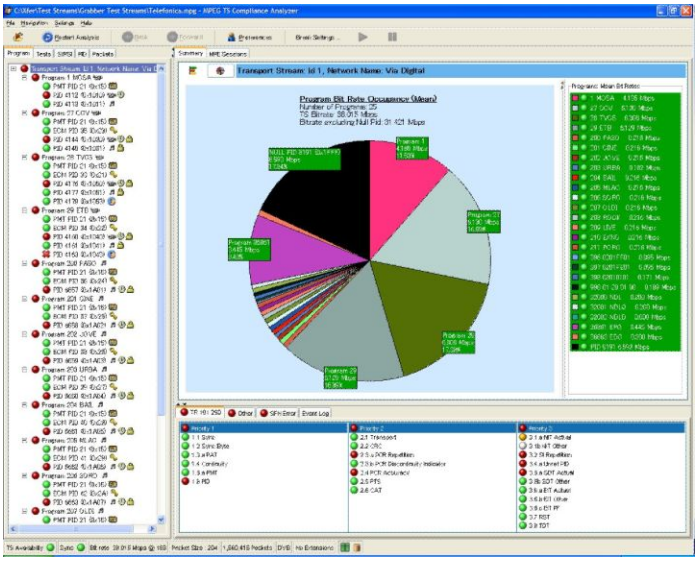
The TSCA offers significant enhancements over traditional software-based deferred-time (stored streams) MPEG analyzers. The combination of an innovative high-speed analysis engine and built-in intelligence, allows ultra-fast pinpointing and debugging of intermittent faults in MPEG Transport Streams used in next-generation DTV and IPTV systems and services.

The TSCA also provides real-time analysis of Transport Streams received through the MTS4000's stream interfaces, including IP and RF. The real-time analysis includes Cross Layer time-correlated IP and TS measurements, alarms, and error logging together with stream recording. The TSCA includes the CaptureVu™ technology and PCR measurement and graphing capabilities. CaptureVu™ technology captures and analyzes system events in real time and deferred time to debug the intermittent and complex problems that traditional analyzers miss.

Standards compliance is ensured through built-in customizable scripting supporting the broadest ranges of ratified and evolving DTV standards, including ATSC, DVB, ISDB-S, ISDB-T, ISDB-TB, and MPEG. To maintain compatibility with the latest standards, flexibility is the key. New standards and proprietary tables can easily be catered for by loading Tektronix-supplied updates, or creating your own custom scripts.

Users can configure the TSCA software to display stream information in user-selected fonts. This feature enables you to view stream information in your local language or to use custom fonts.

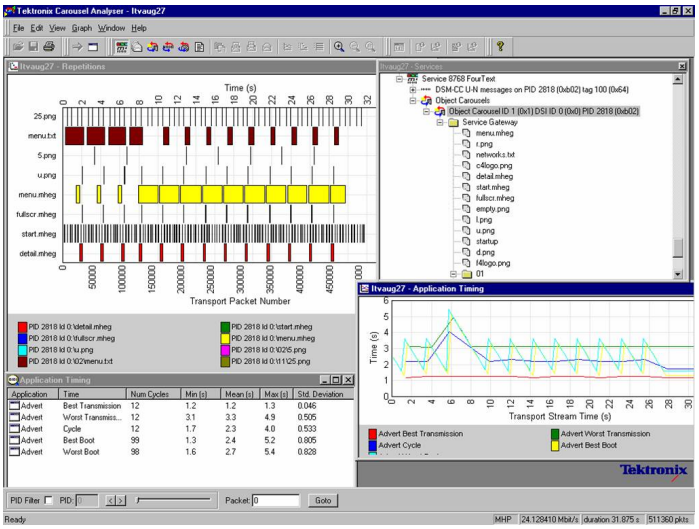
Duplex operation of the real-time TSCA and Player allows end-to-end system test (maximum aggregate bit rate is 400 Mb/s for simultaneous input and output operation).



Transport Stream Compliance Analyzer.

Carousel Analyzer

When developing either data or object carousels for interactive applications, designers not only need to verify the content of carousels, but also whether they are compliant with the relevant standards, and to optimize the settings between transmission bandwidth and responsiveness of the user experience. These settings are mainly concerned with the repetition rates of the various carousel groups. The Carousel Analyzer is designed to address all of these needs for a Transport Stream file containing carousel components. It analyzes carousels compliant with MPEG-2 DSM-CC, DVB (including MHP), DTT (MHEG-5), or ARIB standards.

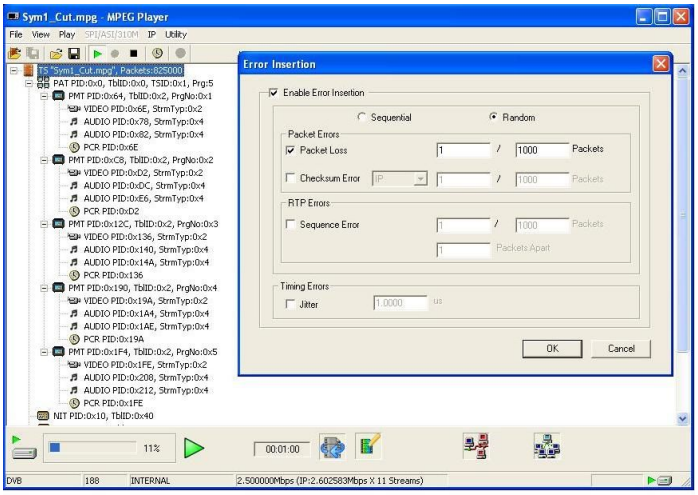


Carousel Analyzer.

Playout (transport stream generation)

The Player tool provides a Transport Stream stimulus for a device under test through the ASI or IP stream interfaces. Continuous playout of looped streams is possible at up to maximum ASI rate of 214 Mb/s with automatic updating of time stamps. Playout rate can be automatically determined from file PCRs or manually set.

Playout through the IP interface provides stimulus with parametric capabilities and multisession replication to characterize behavior of a network or device under test. This capability enables equipment manufacturers developing hardware or software solutions for video distribution over IP and IPTV to ensure quality and performance of products, resulting in reduced development costs and accelerated roll out of next-generation IP broadcast services.



MPEG Player.

Summary of MTS4000 optional tools

Multiplexer and SI Table Editor

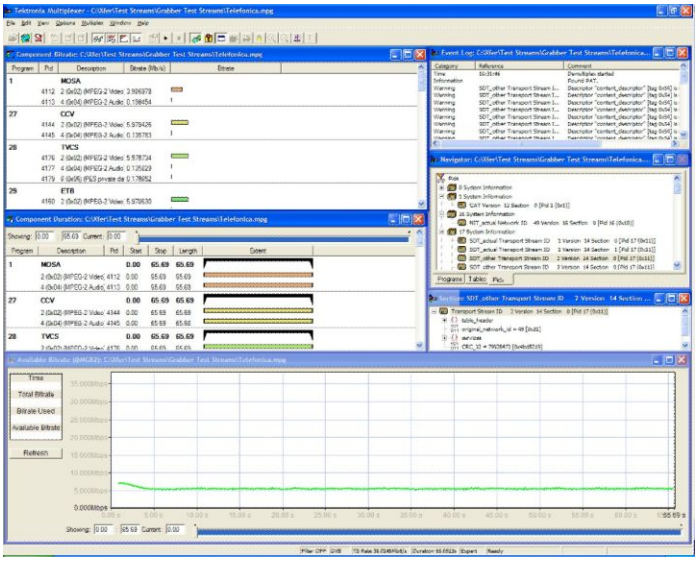
When testing network elements or set-top boxes, a Transport Stream of the representative type needed is often not available. Even if there is a similar one, vital components within it may be missing or suffer from a lack of SI (Service Information) or other tables, or are multiplexed to the incorrect Transport Stream rate for the application.

Use the Multiplexer/Remultiplexer/Demultiplexer application to create and modify multiprogram Transport Streams with custom SI/PSI/PSIP information for DVB, ATSC, ISDB [2], and MPEG-compliant Transport Streams.

Video and audio Elementary Streams may also be multiplexed into a Transport Stream. H.264 streams both with and without SEI timing messages are supported. Bit rate and frame rate auto-detection features help the import process.

This enables the user to create their own test streams that they can use to validate and debug their designs more quickly, and also to create errored streams to perform parametric stress testing and ensure robustness and quality of their MPEG-2 or H.264 implementation.

The **Make Seamless** wizard is provided with the Multiplexer. When looping a Transport Stream to simulate continuous playout, errors can be generated at the loop point caused by discontinuities in timing information. The Make Seamless wizard provides the opportunity of creating a seamless version of a Transport Stream file by adjusting SI and ES components within the stream.



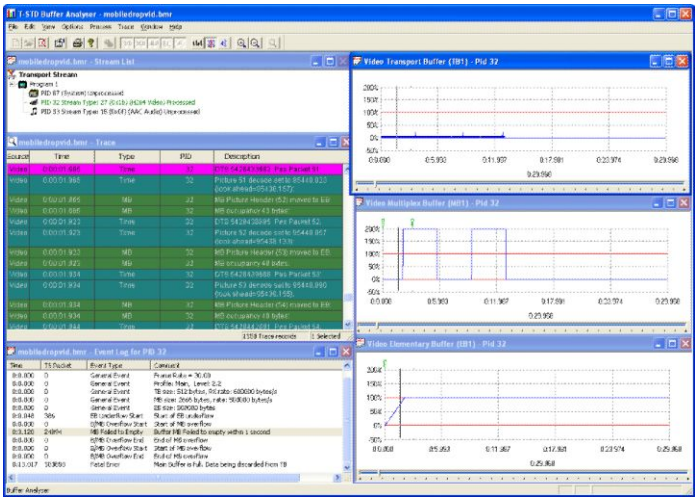
Multiplexer.

Buffer Analyzer

When developing professional and consumer equipment, particularly encoders and set-top boxes, the characteristics of the test streams being either generated or used as stimulus need to be ascertained. Of critical importance among these characteristics is adherence to the buffer model. That is, when the stream is processed by a receiver, will any of the internal buffers be caused to either under- or overflow. Consequences of these conditions are freeze frames and receiver resets.

There are two types of buffer model; the one to use by the receiver is signaled within the Elementary Stream itself. The T-STD method is based upon the DTS values within the PES header and can be used for any contained CODEC type. Additionally, certain video CODECs such as MPEG-2 and H.264/AVC may contain buffer parameters within the ES itself. The Buffer Analyzer verifies conformance of a stream to the T-STD model. Verification of the H.264/AVC HRD method is covered by the MTS4EA product.

2 This includes ISDB-TB (Brazil) and Single Segment mode.

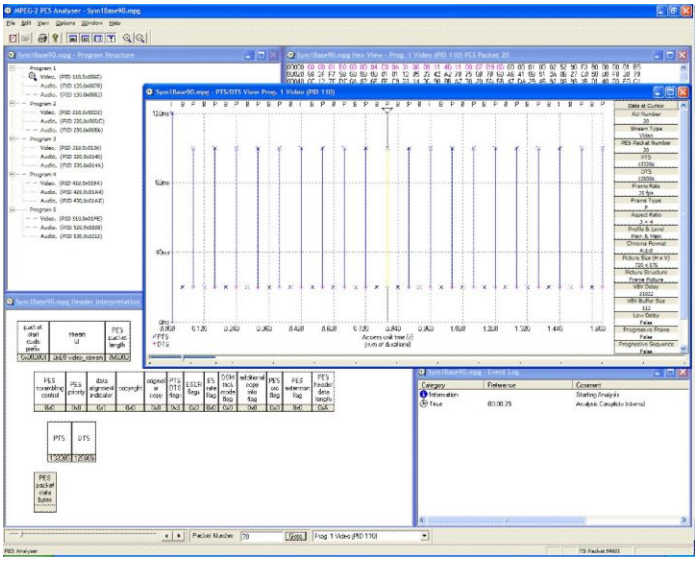


Buffer Analyzer.

Packetized Elementary Stream (PES) Analyzer

When developing professional and consumer equipment, particularly encoders and set-top boxes, the characteristics of the test streams being either generated or used as stimulus need to be ascertained. The header associated with each PES packet is of particular interest, as it contains the decode and presentation time stamps (DTS and PTS) for the contained Elementary Stream.

Errors in these time stamps may cause resets or picture freeze problems at the receiver in extreme cases. They are more typically the cause of lip sync problems where the time stamps of associated video and audio streams are not synchronized. The PES Analyzer is designed to help address these problems and verify conformance of the PES header contents to the MPEG, DVB, and ATSC standards.



Packetized Elementary Stream (PES) Analyzer.

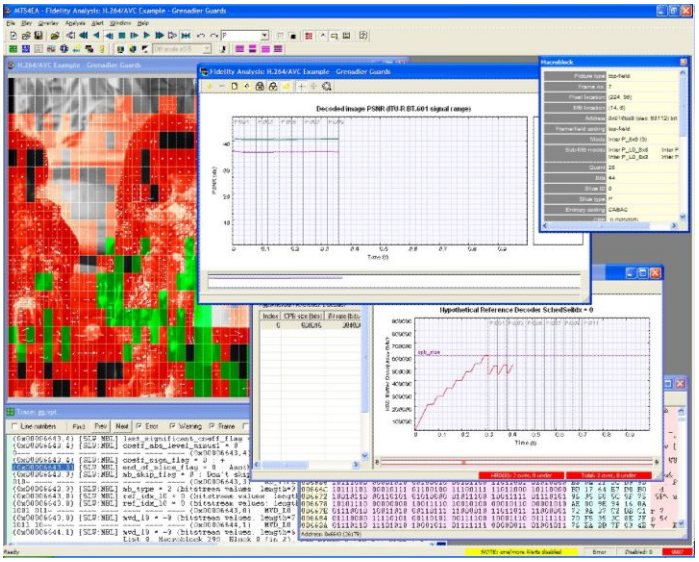
Creating, editing, and resizing transport streams

Two direct stream manipulation packages are supplied as standard with the MTS4000. TS Cutter allows resizing of Transport Streams. TS Editor allows direct editing of Transport Streams using a hexadecimal view and a header interpretation guide.

MTS4EAV7 HEVC/AVC ES Analyzer

Whether developing a new codec chip, integrating a codec into professional or consumer equipment, or integrating different vendor's equipment when rolling out new services, the ability to verify the compliance of an Elementary Stream is crucial. This tool checks for compliance of an Elementary Stream to either next-generation VC-1, HEVC/H.265, AVC/H.264, and MPEG-4 standards, or legacy MPEG-2 and H.263. Audio decode and waveform display of MPEG-2 audio (ISO/IEC 13818 parts 3 and 7), AC-3, and MPEG-4 AAC are also supported.

Comprehensive diagnostic capabilities including semantic trace view to determine Frame-by-Frame and Block-by-Block encoder decision making. Synchronized displays allow the user to quickly ascertain the details of each reported error. A bitstream editor allows the effects of planned encoder updates to be quickly understood.

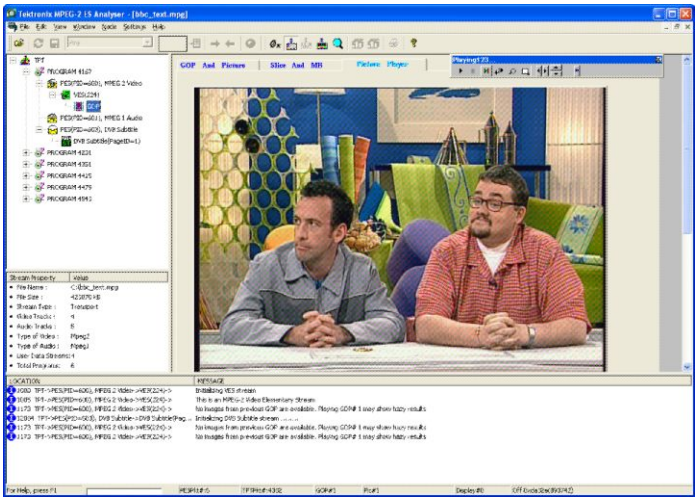


MTS4EAV7 HEVC/AVC ES Analyzer.

Elementary Stream (ES) Analyzer

The ES Analyzer is intended for codec design, optimization, and conformance purposes. It provides the ability to view the moving picture from within a PES stream and carry out a whole range of sophisticated tests on the lower layers of an Elementary Stream within a Transport Stream. In addition, it both analyzes and displays a range of extended media formats, including ATSC Closed Captions, DVB Subtitles, and Teletext associated with video Elementary Streams.

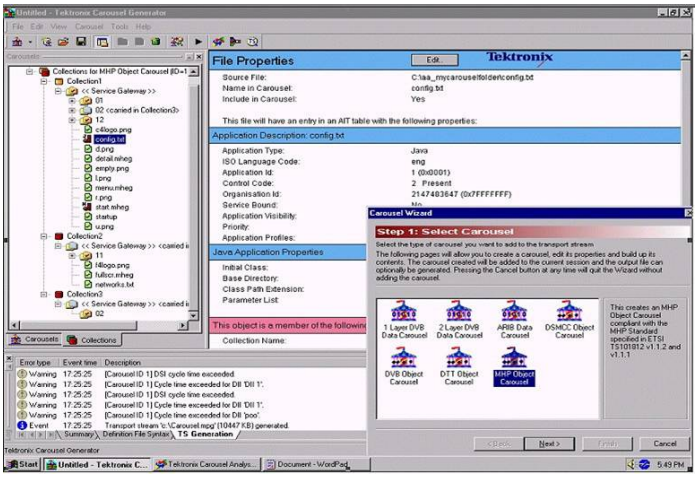
For analysis of MPEG-4, HEVC/H.265, AVC/H.264, and VC-1 and MPEG-2 Elementary Streams, please refer to the MTS4EAV7 HEVC/AVC ES Analyzer.



MPEG-2 ES Analyzer.

Carousel Generator

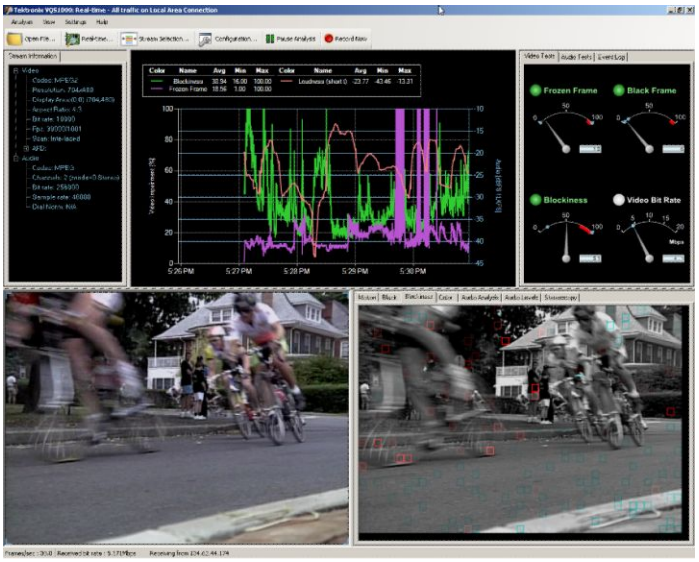
The Carousel Generator product is used for creating object carousel contents within an output Transport Stream. This is particularly useful in test situations where the effects of varying parameters, such as individual repetition intervals, may be quickly ascertained. The generator will create object carousels conforming to the MPEG-2 DSM-CC, DVB, DTT (MHEG-5), or MHP standards.



Carousel Generator.

VQS1000 Video Quality Software

VQS1000 video quality software enables QoE monitoring capabilities and real-time assessment of video impairments on MPEG-2 or H.264 encoded content, including stuck, black, blockiness, and compression artifacts for selected services. The VQS1000 performs a full decode on the video stream that allows operators to determine the source of a problem (content source, network distribution, etc.). Engineers can clearly see and validate the presence of impairments on the image using unique impairment displays that highlight the location and severity of video defects. In addition, audio diagnostics allow operators to analyze audio loudness related problems to the ITU-R BS.1770/1771 audio loudness standard.

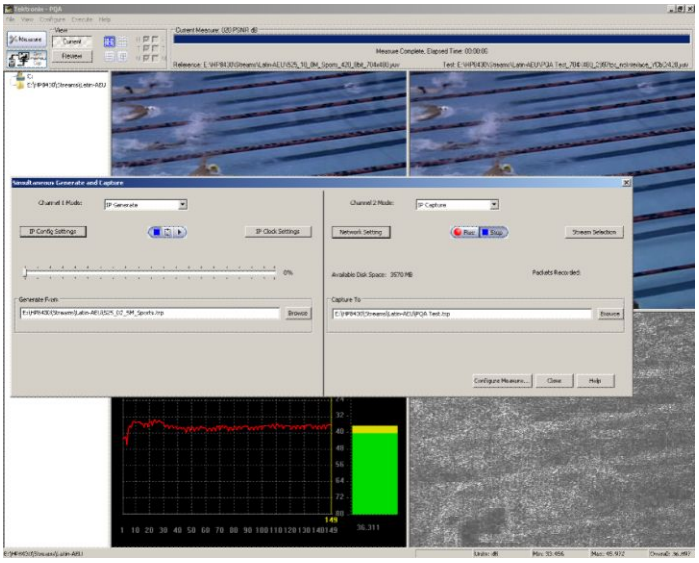


VQS1000 Video Quality Software.

PQASW with IP Option

PQASW is picture quality analysis software based on the concepts of the human vision system which provides repeatable, objective quality measurements that closely correspond with subjective human visual assessment. These measurements provide valuable information to engineers working to optimize video compression and recovery, and maintain a level of common carrier and distribution transmission service to clients and viewers.

The IP interface enables both generation and capture of compressed video with two modes of simultaneous operation. Simultaneous generation and capture lets the user playout the reference video clips directly from an IP port in the PC into the device under test. The test output from the device can then be simultaneously captured by the PC. This saves the user from having to use an external video source to apply any required video input to the device under test. With this generation capability, files created by video editing software can be directly used as reference and test sequences for picture quality measurements.



PQASW Picture Quality Analyzer.

Performance you can count on

Depend on Tektronix to provide you with performance you can count on. In addition to industry-leading service and support, this product comes backed by a one-year warranty as standard.

Specifications

Platform characteristics

Operating system	Windows 7 Ultimate, 64 bit
Processor	Intel i7 860 Quad-core CPU
Hard disk drive	Two 500 GB SATA HDDs One for storing OS and SW applications, and one for storing Record and Playout files
RAM	4 GB
Optical storage drive	DVD±RW
Display	LCD, 1280×1024, 17 in.
External DVI output	Dual DVI: One for internal LCD, 2nd for external display
Ethernet	Ethernet 10/100/1000 (GigE) Two 10/100/1000BASE-T; RJ45 connector on the side
COM port	Two RS-232
USB port	Six USB 2.0, two on the front and four on the side

Instrument characteristics – Multiport ASI

Connector	BNC (×4)
	75 Ω transformer-coupled input and output
	800 mV ±10% into 75 Ω load output
	200 mV to 880 mV input
	Return loss less than –17 dB (5 MHz to 270 MHz) into a 75 Ω load
Bit rate	250 Kb/s to 214 Mb/s (in accordance DVB specification maximum)
	Input and output aggregate bit rate (simplex or duplex operation)

IP video interface (Option IPTV) characteristics

Ethernet ports	10/100/1000BASE-T, 1000BASE-SX, LX, ZX
Port options	
Opt. IPTV	Gigabit Ethernet Interface with 10/100/1000BASE-T RJ45 electrical port
Opt. SX	1000BASE-SX Short Wavelength Optical port with LC connector for Gigabit Ethernet Interface (Multi Mode 850 nm) [3]
Opt. LX	1000BASE-LX Long Wavelength Optical port with LC connector for Gigabit Ethernet Interface (Single Mode 1310 nm) [3]
Opt. ZX	1000BASE-ZX Optical port with LC connector for Gigabit Ethernet Interface (Single Mode 1550 nm) [3]
Maximum data rate	Line rate
ASI output	ASI compliant with specification EN 50083-9 ASI smoothing can be activated to compensate for bursty IP traffic
Protocol stack support	IPv4 and v6 support
	UDP/IP/Ethernet
	UDP/IP/VLAN/Ethernet
	RTP/UDP/IP/Ethernet
	RTP/UDP/IP/VLAN/Ethernet
Multicast and control support	IGMP v2 and v3
	MLD v1 and v2
	ARP
	ICMP (Inbound and Outbound ping)
IP packet support	7 Transport Stream packets per IP packet (188 byte packets)
	FEC (FEC is parsed but is not processed)
IP video metrics	Session Support Discovery of up to 500 IP sessions
	Simultaneous monitoring of key parameters including
	Continuity Count and Sync Byte
	Packet Interarrival Time (PIT) for all sessions
	RTP sessions are monitored for Out of Order and Dropped Packets

3 Optical SFP module which plugs into IP Video Card GE to provide optical connectivity.

10G interface (Option 10GS) characteristics

Ethernet ports	Dual 10G-BASE
Port options	Standard Dual SFP plus Short Wavelength Optical port with LC connector for 10 Gb Ethernet interface (Multi Mode 850 nm)
Maximum data rate	600 Mb/s

8VSB interface (Option VS) characteristics

Input frequency range	54 MHz to 860 MHz, VHF/UHF channels 2 to 69 (to include low VHF frequencies)
Input signal level	–72 dBm to –6 dBm (–23 dBmV to +43 dBmV) typical
Modulation format	8VSB in accordance with ATSC A/53B
Receiver bandwidth	6 MHz
Input termination impedance	75 Ω nominal
Connector type	F-type Connector
Input return loss	5 dB typical
RF measurements	
RF Lock	RF lock is indicated by a LED on the rear panel and a status indicator on the UI
Input Level	Range: –72 dBm to –2 dBm; –23 dBmV to +47 dBmV relative to 75 Ω
	Resolution: 1 dB
	Accuracy: ±3 dB up to –6 dBm input level typical; ≥ –50 dBm to ensure compliance to IEC 61000-4-3 immunity
EVM (Error Vector Magnitude)	Display range: 3% to 12.5% rms
	Resolution: 0.1% typical
Equivalent MER (Modulation Error Ratio)	Display range: 15 dB to 36 dB
	Resolution: 1 dB
	Accuracy: ±1 dB for MER <25 dB typical; ±3 dB for MER 25 dB to 31 dB typical
SNR (Signal-to-Noise Ratio)	Display range: 15 dB to 35 dB
	Resolution: 1 dB
	Accuracy: ±1 dB for SNR <25 dB; ±3 dB for SNR 25 dB to 35 dB typical
BER (Bit Error Ratio)	Pre FEC, SER, and Error Sec BER values displayed on UI

QAM B interface (Option QB2) characteristics

Input frequency range	88 MHz to 858 MHz, 62.5 kHz steps
Modulation format	64QAM, 256QAM compliant with ITU J-83 [4] SCTE07 Compliant
Modulation baud rate	5.057 Mbaud/s and 5.360 Mbaud/s
Input signal level	–64 dBm to –19 dBm (45 dBuV to 90 dBuV relative to 75 Ω) with a 64 and 256 QAM input typical
Ultimate modulation error ratio	37 dB typical
Receiver bandwidth	6 MHz nominal
Input termination impedance	75 Ω nominal
Input return loss	–6 dB min, –10 dB typical, 51 MHz to 858 MHz
RF measurements	
RF Lock	RF lock is indicated by a LED on the rear panel and a status indicator on the UI
Input Level (Signal Strength)	Range: –64 dBm to –19 dBm Resolution: 1 dBm Accuracy: ±3 dBm typical
EVM (Error Vector Magnitude)	Display range for 64 QAM: ≤1% to ≥5% RMS Display range for 256 QAM: ≤1% to ≥2.5% RMS Resolution: 0.1% Accuracy: within 20% of reading for S/N >25 dB typical
MER (Modulation Error Ratio) with Equalizer	Display range for 64 QAM: 22 dB to 37 dB Display range for 256 QAM: 28 dB to 37 dB Resolution: 0.1 dB Accuracy: ±1 dB for MER <25 dB; ±3 dB for MER 25 dB to 34 dB typical
Signal-to-Noise Ratio (SNR)	Display range for 64 QAM: 22 dB to 37 dB Display range for 256 QAM: 28 dB to 37 dB Resolution: 1 dB Accuracy: ±1 dB for MER <25 dB; ±3 dB for MER 25 dB to 34 dB typical
BER (Bit Error Ratio)	Pre FEC, SER, and Error Sec BER values displayed on UI
Post RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (uncorrectable error count) and number of Transport Error Flags are displayed on the UI
Constellation	The RF constellation is displayed on the UI

4 Level 1 and Level 2 interleaving support compliant with all ITU J-83 Annex B, excluding I, J = 128, 7 and 128, 8 for 64QAM and in 256QAM excluding I,J = 8, 16 and 16, 8.

DVB-S2 interface (Option S2) characteristics

Input frequency range	950 MHz to 2150 MHz with 1 MHz step size
Input signal amplitude range	–60 dBm to –30 dBm for a CBER of $<1e^{-6}$
Modulation format	QPSK in accordance with DVB-S (ETSI EN 300 421) QPSK, 8PSK, 16APSK, and 32APSK in accordance with DVB-S2 (ETSI EN 302 307) including Constant and Variable Coding and Modulation (CCM and VCM)
Modulated baud rate	1 MBaud min, 45 MBaud max
Code rate	DVB-S: 1/2, 2/3, 3/4, 5/6, 6/7, 7/8 DVB-S2: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
FEC modes	Viterbi and Reed-Solomon in accordance with DVB-S LDPC and BCH in accordance with DVB-S2 Short and Normal FEC blocks in accordance with DVB-S2
Roll off	0.2, 0.25, 0.35
Connector style	F-style
Input termination impedance	75 Ω nominal
Input return loss	>6 dB min, 950 MHz to 2150 MHz
LNB supply voltage	Selectable; 13.0 V ±1.5 V or 18.0 V ±1.5 V, with 100 Ω, 5 W resistor load
LNB supply maximum current	200 mA max
LNB 22 kHz signaling frequency	17.6 kHz min, 26.4 kHz max (22 kHz ±20%)
LNB 22 kHz signaling amplitude	600 mV_{p-p} with 100 Ω load
LNB mode	DiSEqC 2
Ultimate MER (Modulation Error Ratio)	30 dB with equalizer
Measurements	
RF Lock	RF lock is indicated by a LED on the rear panel and a status indicator on the UI
Input Level	Range: –60 dBm to –30 dBm
Signal Strength	Resolution: 1 dBm Accuracy: ±5 dBm
EVM (Error Vector Magnitude)	Display range: ≤4.0% to ≥30.0% RMS Resolution: 0.1% Accuracy: ±20% of reading
MER (Modulation Error Ratio) with Equalizer	Display Range: 10 dB to 30 dB with equalizer Resolution: 1 dB Accuracy: ±2 dB for range 10 dB to 20 dB

DVB-S2 interface (Option S2) characteristics

CNR (Carrier-to-Noise Ratio)	Display Range: 10 dB to 30 dB Resolution: 1 dB Accuracy: ±2 dB for range from 10 dB to 28 dB
Phase Noise	Display Range: 5° to 45° RMS Resolution: 1°
Pre-Viterbi BER	Pre-Viterbi BER displayed
Pre-Reed Solomon (RS) BER	Pre-RS BER displayed
Pre-LDPC BER	Pre-LDPC BER displayed
Pre-BCH BER	Pre-BCH BER displayed
Post-RS BER and TEF (Transport Error Flag)	Post Reed Solomon BER (TEF ratio), TEF rate, and number of Transport Error Flags (TEF count) displayed to the user
Transmission Parameters	All coding and modulation parameters are indicated to the user in the UI; Transport Stream monitor must be tuned to a valid Transport Stream in order to report RF transmission parameters
Constellation	The RF constellation is displayed on the UI

Physical characteristics

Dimensions	
Height	346.0 mm (13.62 in.)
Width	434.5 mm (17.01 in.)
Depth	243.0 mm (9.57 in.)
Weight	
Net	17.0 kg (37.48 lb)
Shipping	20.2 kg (44.53 lb)

Environmental characteristics

Temperature	
Operating	+5 °C to +40 °C
Non-operating	–20 °C to +60 °C
Humidity	
Operating	20% to 80% relative humidity, non-condensing
Non-operating	10% to 80% relative humidity, non-condensing
Altitude	
Operating	Up to 3,000 m (9,800 ft)
Non-operating	Up to 12,000 m (40,000 ft)
Power	
Source voltage	100 to 240 V AC
Frequency	50 to 60 Hz
Consumption	220 W

Ordering information

Models

MTS4000 MPEG Test System	Includes the following: - Real and deferred time TS Compliance Analyzer - TS Cutter - Carousel Analyzer - Player - GbE (NIC) Interface

Options

MTS4000 standard options

GEN	Adds Stream Generation – Includes Multiplexer, TS Editor, Make Seamless, Carousel Generator, and Tclips Test Streams
ESS	Adds Standard ES Analysis – Includes MTS4CC with all options plus MPEG-2 ES Analyzer
ESB	Adds Enhanced ES Analysis – Includes MTS4EAV7 base software (AVC) plus MPEG-2 ES Analyzer
ESE	Adds Enhanced ES Analysis – Includes MTS4EAV7 with all options (including HEVC) plus MPEG-2 ES Analyzer
VQ	Adds Video Quality Software, Single Ended – Includes VQS1000 with all options
PQ	Adds Picture Quality Analysis Software, Single and Double Ended – Includes PQASW with Option IP
PB	Adds PES and T-STD Buffer Analyzers
ASI	Adds Multiport ASI Interface
S2	Adds DVB-S/S2 Interface supporting QPSK, 8PSK, 16APSK, and 32APSK Demodulation (requires Option ASI)
VS	Adds 8VSB Interface (requires Option ASI)
QB2	Adds QAM B Interface (requires Option ASI)
IPTV	Adds IPTV Gb Ethernet Interface with 10/100/1000BASE-T RJ45 Electrical Port (requires Option ASI)
SX	Adds 1000BASE-SX Short Wavelength SFP Optical Port with LC Connector for IPTV Ethernet Interface (Multi Mode 850 nm)
LX	Adds 1000BASE-LX Long Wavelength SFP Optical Port with LC Connector for IPTV Ethernet Interface (Single Mode 1310 nm)
ZX	Adds 1000BASE-ZX SFP Optical Port with LC Connector for IPTV Ethernet Interface (Single Mode 1550 nm)
10GS	Adds 10GBASE-SR Dual Optical Port 10 Gb/s NIC – Includes Short Reach SFP+ Modules (850 nm)

MTS4000 options package

430	Includes the following: - Multiplexer, TS Editor, Make Seamless, Carousel Generator, and Tclips Test Streams - PES and Buffer Analyzers - MTS4EAV7 with all options (including HEVC) - MPEG-2 ES Analyzer

Power plug options

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A3	Australia power plug (240 V, 50 Hz)
Opt. A4	North America power plug (240 V, 50 Hz)
Opt. A5	Switzerland power plug (220 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 110/120 V, 60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A99	No power cord

Language options

Opt. L0	English manual

Russian, Chinese, and Japanese manuals are available in electronic format.

Service options

Opt. C3	Calibration Service 3 Years
Opt. C5	Calibration Service 5 Years
Opt. R3	Repair Service 3 Years (including warranty)
Opt. R3DW	Repair Service Coverage 3 Years (includes product warranty period). 3-year period starts at time of instrument purchase
Opt. R5	Repair Service 5 Years (including warranty)
Opt. R5DW	Repair Service Coverage 5 Years (includes product warranty period). 5-year period starts at time of instrument purchase

MTS4KUP field upgrade options

GEN	Adds Stream Generation – Includes Multiplexer, TS Editor, Make Seamless, Carousel Generator, and Tclips Test Streams
ESS	Adds Standard ES Analysis – Includes MTS4CC with all options plus MPEG-2 ES Analyzer
ESB	Adds Enhanced ES Analysis – Includes MTS4EAV7 base software (AVC) plus MPEG-2 ES Analyzer
ESE	Adds Enhanced ES Analysis – Includes MTS4EAV7 with all options (including HEVC) plus MPEG-2 ES Analyzer
VQ	Adds Video Quality Software, Single Ended – Includes VQS1000 with all options
PQ	Adds Picture Quality Analysis Software, Single and Double Ended – Includes PQASW with Option IP
PB	Adds PES and T-STD Buffer Analyzers
ASI	Adds Multiport ASI Interface
S2	Adds DVB-S/S2 Interface supporting QPSK, 8PSK, 16APSK, and 32APSK Demodulation (requires Option ASI)
VS	Adds 8VSB Interface (requires Option ASI)
QB2	Adds QAM B Interface (requires Option ASI)
IPTV	Adds IPTV Gb Ethernet Interface with 10/100/1000BASE-T RJ45 Electrical Port (requires Option ASI)
SX	Adds 1000BASE-SX Short Wavelength SFP Optical Port with LC Connector for IPTV Ethernet Interface (Multi Mode 850 nm)
LX	Adds 1000BASE-LX Long Wavelength SFP Optical Port with LC Connector for IPTV Ethernet Interface (Single Mode 1310 nm)
ZX	Adds 1000BASE-ZX SFP Optical Port with LC Connector for IPTV Ethernet Interface (Single Mode 1550 nm)
10GS	Adds 10GBASE-SR Dual Optical Port 10 Gb/s NIC – Includes Short Reach SFP+ Modules (850 nm)

Standard accessories

063-4385-xx	MTS4000 Application Software CD-ROM
063-4386-xx	MTS4000 Product Documentation CD-ROM
063-4387-xx	MTS4000 Operating System Restore DVD (MTS4000 only)
071-2970-xx	MTS4000 and MTS4SA Quick Start User Manual
NA	USB hardware key (dongle)
NA	Power cord (see Power plug options)

CE

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Updated 10 April 2013

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23 Jan 2014

2AW-27277-3

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